standards are based on the California Building Code and any local amendments to the Building Code.

5.0 FLOODING

5.1 Flood Prone Areas and Flood Control Programs

The primary causes of flooding are excessive surface runoff resulting from heavy rainfall, extremely high tides, and the failure of flood control or water supply structures such as levees and reservoirs. Although it is not possible to prevent excessive rainfall, it is possible to manage areas subject to flooding to protect life and property. Through the use of hydrologic data, regulatory controls, and flood proofing measures, land use planning can effectively reduce flood hazards.

Flooding generally occurs in some of the lower elevations of Fremont near San Francisco Bay. FEMA maps of the 100-year flood zone primarily indicate flood hazards in the marshes and alluvial terraces adjacent to the outlets of Crandall Creek, Newark Slough, Plummer Creek, Mowry Slough, and Coyote Slough. Additional flooding occurs around Lake Elizabeth (see Figure 5). Most of the city's flood prone areas have been designated for permanent open space such as salt ponds, parks, and wetlands. However, a 100-year flood could affect portions of the Northern Plain Planning Area, the city's industrial areas west of I-880 and south of Warren Avenue, and along Laguna Creek.

Extensive flooding along Alameda Creek and adjacent farms and roads in 1955 and 1958 prompted the creation of the Alameda County Flood Control District (later the Alameda County Flood Control and Water Conservation District, or ACFCWCD). The ACFCWCD redirected the creek into a 200-foot-wide, 10-mile-long flood control channel. By 1965, channel improvements along the creek and dams on its tributaries were determined to have reduced the threat of flooding to less than once every 100 years. Formerly flood-prone areas in the Northern Plain and Niles sections of Fremont were subsequently developed.

Fremont's eight smaller creeks have been greatly altered by flood control projects. Instead of meandering as they once did, the creeks now flow across the Bay Plain in relatively straight channels. For flood control purposes, vegetation along the channels is kept to a minimum and access is restricted by chain-link fences. Most of the channels were designed to retain a flood with a one in 50 chance of occurring in any given year (i.e., the 50-year flood).

Flood protection responsibilities by the ACFCWCD include maintenance of the flood channels. This includes dredging, silt removal, and erosion repair for lakes, ponds, and creeks in Fremont. The ACFCWCD also operates and maintains 22 pump stations that collect stormwater from low-lying areas during heavy storms and high tides and discharge it to San Francisco Bay. The District has permitting authority for storm drainage in its service area, including discharge point connections. ACFCWCD reviews drainage plans associated with development for consistency with its policies and

regulations regarding runoff, stormwater management, detention, flooding, and bank erosion.

Although ACFCWCD has a separate funding source, it functions as an arm of the Alameda County Public Works Department. The ACFCWCD is divided into ten zones which correspond to the major watersheds of Alameda County. Fremont is in Zone 5 and Zone 6, which are described below.

Flood Control Zone 5

Zone 5, covering 45,440 acres, is one of the District's largest zones. Its watersheds stretch from the Fremont and Hayward hills to the shoreline of San Francisco Bay and include Newark and the northern portions of Fremont. Over 36 miles of natural waterways are found in this zone including Crandall Creek, Dry Creek and Plummer Creek and Newark and Mowry Sloughs. In addition, engineered drainage channels, ditches, and over 50 miles of closed conduits and pipelines carry runoff through this area. Stormwater flows out to three pump stations, which discharge to San Francisco Bay. The Alameda Creek and its popular trails are located in Zone 5 as is the Tule Pond Education Center. [13]

Flood Control Zone 6

Zone 6, covering 27,400 acres in southern Alameda County, includes the Irvington, Mission San Jose, and Warm Springs areas of Fremont. Zone 6 is home to a number of natural creeks including Laguna, Mission, Canada Del Aliso, Agua Caliente, Agua Fria, Toroges, and Scott. These waterways originate in the foothills of Mission Peak, Mt. Alison, and Monument Peak and flow through the City toward the Bay. Within the urbanized area, stormwater reaches San Francisco Bay by flowing through a series of pipelines and earthen and concrete channels to either Mowry Slough or Coyote Creek. Coyote Creek forms the border between Alameda and Santa Clara Counties. Stormwater flows through these waterways to San Francisco Bay for discharge. [14]

The ACFC/WCD will face new challenges as additional development increases the extent of impervious surfaces (streets, rooftops, and other paved areas) and accelerates the flow of runoff. Development in the hills also poses challenges, as it may increase erosion and sedimentation in drainage channels. It will be important to find ways to provide adequate protection against flooding locally and downstream while preserving the natural beauty, habitat and other open space values of the city's creeks (wildlife habitats, vegetation). The District and City will continue to collaborate to balance flood control needs with the need to preserve Fremont's remaining natural creeks.[15]

5.2 Dam Failure

Dam failures are one of the greatest threats to life and property of all natural disasters because of the large population typically exposed to danger. Risk of inundation as result of dam failure includes the majority of Fremont's urbanized areas. It is possible that three dams have the potential to flood the city. These dams are located in the upper reaches of the Alameda Creek watershed and include Del Valle Dam and the Arroyo Valle

Reservoir, James H Turner Dam and the San Antonio Reservoir and Calaveras Dam and the Calaveras Reservoir. All three reservoirs are located to the east and southeast of Fremont and have the potential to flood the city via Alameda Creek. The severity and risk of flooding is related to earthquake faults in the area, as well as dam storage conditions and the timing and severity of individual dam failures. These dams include:

- **Calaveras** - 100,000 acre-feet capacity - owned by City/County of San Francisco
- **Del Valle** - 77,100 acre-feet capacity - owned by CA Dept of Water Resources
- **James H Turner** - 50,500 acre-feet capacity - owned by City/County of San Francisco

The failure of water storage tanks is another concern shared by the City and Water District. There are several tanks and reservoirs located on the lower slopes of Fremont's eastern hills. If these facilities failed, a large volume of water would suddenly be released downslope. Most water tanks and reservoirs are located in areas away from residential development, so the released water would pond on flatland.

5.3 Levee Failure

Levee failure also poses a great risk to life and property in areas where levees protect surrounding property from sea level rise, surge and flooding. The City has two primary levees located along Alameda Creek and protecting the south Baylands area. If the levees were to fail then property adjacent to these areas would be susceptible to flooding and flood damage. The Alameda County Flood Control District has jurisdictional authority over the maintenance of the levees. Recent natural disasters and current concerns over rising sea levels have brought attention to the susceptibility of levee failure.

Levee Accreditation

FEMA, as part of the nationwide Flood Map Modernization project, has asked communities and levee owners to show that levees, which are currently designated as protecting land from flooding, continue to meet minimum design, operation, and maintenance standards consistent with the National Flood Insurance Program regulations. FEMA identified two levee systems in Fremont that provide flood protection and must be accredited by FEMA. The two levee systems are along Alameda Creek and Coyote Creek,

In August 2007, the City and ACFCWCD agreed to pursue accreditation of these levee systems by providing necessary documentation to demonstrate the levees meet the requirements of the National Flood Insurance Program. In response, FEMA designated both levee systems as provisionally accredited levees (PALs). The PAL designation requires that the City and ACFCWCD provide FEMA with the necessary accreditation documents by August 7, 2009. Should either or both levee systems not be accredited, the land areas behind the levees will be designated by FEMA as special flood hazard areas, or areas within the 100-year flood plain.

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General Plan 2030

Health and Safety
Dam Failure Inundation Areas

Legend

- City Boundary
- Water feature

Dam Failure Inundation Areas

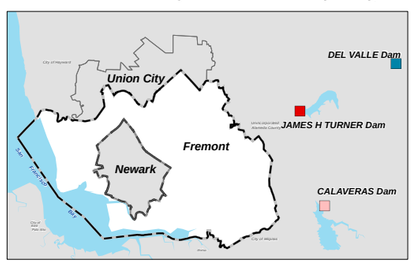
- Calaveras
- Del Valle
- Turner
- Calaveras/Turner
- Calaveras/Del Valle
- Del Valle/Turner
- Calaveras/Turner/Del Valle

If multiple reservoirs are listed under one color, the area shown with that color will be inundated if ANY listed dam fails; it does not infer that all dams must fail concurrently to inundate the area shown.

This map shows the maximum extent of damage of a flood wave emanating from dam failure. The map does not indicate or infer the probability of such an event occurring.

This hazard map is generalized from maps dam owners are required to prepare and file with the California State Office of Emergency Services. The current version of this map is available on the Internet at http://www.abag.ca.gov

Source: Association of Bay Area Governments (ABAG), 1995



The information conveyed on this map is dynamic and may have changed after this map was printed. Please consult the Planning Division or other appropriate agency for the most recent information or status.

Users should verify designations, policies, regulations, and restrictions before making project commitments.

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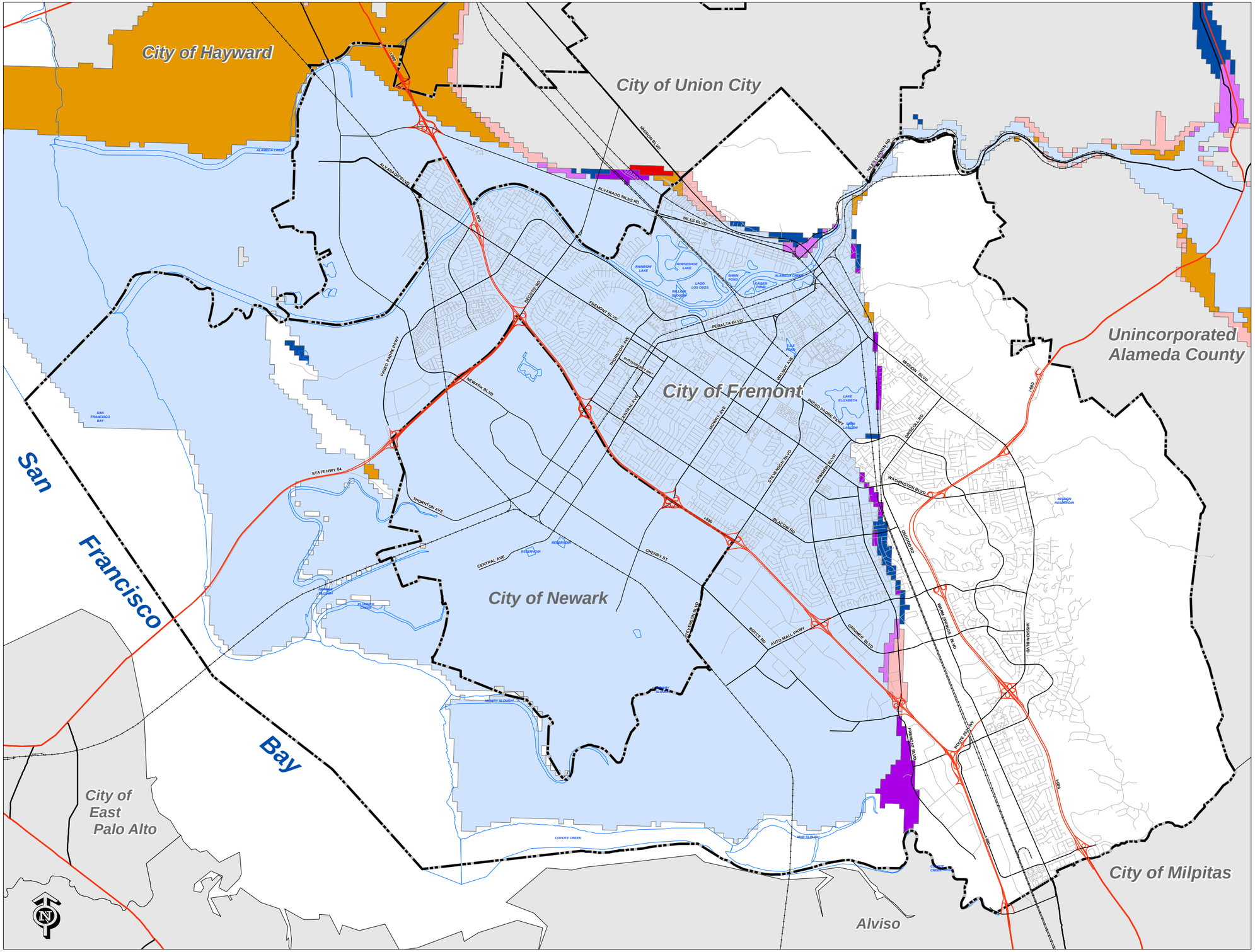

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FIGURE 5

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5.4 Regulatory Setting

National Flood Insurance Program (NFIP)

Fremont is one of approximately 20,000 communities nationwide that participates in the National Flood Insurance Program operated by the FEMA. The NFIP is a Federal program that enables property owners in participating communities to purchase insurance protecting against flood loses in exchange for State and community floodplain management regulations that reduce future flood loses. The 100-year flood is used as the benchmark for flood plain management.

Fremont Municipal Code

The Fremont Municipal code contains ordinances that directly pertain to flooding. The relevant provisions appear under Title 8, Planning and Zoning. Chapter 8, Flood Damage Prevention. The ordinance promotes the health, safety and general welfare of Fremont's residents by preventing loss due to flood conditions in specific areas. The intent of the ordinance is to:

(a) Protect human life and health

(b) Minimize expenditure of public money for costly flood control projects

(c) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public

(d) Minimize prolonged business interruptions

(e) Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard.

(f) Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas.

(g) Ensure that potential buyers are notified that property is in an area of special flood hazard.

(h) Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

The purpose of the City's ordinances is to regulate development which could reduce the water carrying capacity of drainage ways, or expose property to flood hazards. For example, hillside development is analyzed for its impact on downstream drainage. Stormwater detention facilities are required where appropriate to reduce runoff volumes. In addition, construction in flood prone areas must be raised above the 100-year base flood elevation as defined for that location.

5.5 FEMA Flood Maps

In November 1982, FEMA issued a Flood Insurance Study (FIS) for the City of Fremont. Six months later, in May 1983, the City of Fremont became a regular participating community in the NFIP, when FEMA released the first Flood Insurance Rate Maps (FIRM) for the City. The FIS and FIRM identify flood risk within the community.

The first major revision to the FIS and FIRM occurred in July 1987. The 1987 revision incorporated detailed flooding information from a 1984 report by the Army Corps of Engineers. The 1987 revision included increasing the 100-year water surface elevations of the San Francisco Bay from a previous elevation of 7 feet to new elevations of 8 feet and 9 feet.

The last and most recent revision to the FIS and FIRM was in February 2000. This revision incorporated detailed flood hazard information from several ACFCWCD channels, including Torges Creek, Laguna Creek, and Aqua Caliente Creek. The 2000 revision increased the special flood hazard area in the Irvington District along Laguna Creek, between Lake Elizabeth and Auto Mall Parkway.

FEMA has recently begun a Flood Map Modernization project. The project purpose and goal is to take advantage of improved technologies and provide more dynamic mapping of flood hazards. The first stage of the project is to convert the existing paper maps into a digital format. Preliminary digital maps were reviewed by the City in early 2008. The City anticipates that official digital maps will be issued by FEMA in late 2008 or early 2009. The digital maps will be essentially the same as the paper maps revised in 2000.

5.6 Sea-Level Rise

Historical records show that sea level in San Francisco Bay has risen 18-20 cm (7 inches) over the past 150 years. The Intergovernmental Panel on Climate Change and the 2006 California Climate Action Team Report project that mean sea level will rise between 10 and 90 cm (12 and 36 inches) by the year 2100. Sea level rise models indicate that a 30 cm (11.8 inch) rise in sea level would shift the 100-year storm surge-induced flood event to once every 10 years. With each flood event, the Bay Area stands to lose valuable real estate, critical public infrastructure, and natural resources.

Through the sea level rise mapping project, BCDC employed geographic information system software to identify the shoreline areas likely to be most impacted by sea level rise. The sea level rise maps are generally consistent with the projections in the 2006 California Climate Action Team Report. They illustrate an impact scenario in which sea level rises one meter by the year 2100. Limitations in the geospatial data may effect accuracy. Therefore, they are illustrative and should not be used for small-scale planning purposes. The maps are based on USGS 2005 Urban Areas digital elevations and National Agriculture Imagery Program 2004 aerials.

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General Plan 2030

Health and Safety

2006 FEMA DFIRM

Draft Flood Hazard Data

Legend

City Boundary

Flood Zone Designations

- **A**
- **AE**
- **AH**
- **AO**
- **B and X (shaded)**
- **C and X (unshaded)**
- **D**
- **VE**

The Federal Emergency Management Agency (FEMA) draft Digital Flood Insurance Rate Maps (DFIRM) designations shown on this map of the Tri-City area are listed below. Mandatory Flood Insurance purchase requirements apply to Zones A, AE, AH,& AO.

Zone A is the flood insurance rate zone used for 1-percent-annual-chance (base flood) floodplains that are determined for the Flood Insurance Study (FIS) by approximate methods of analysis.

Zones AE and **A1-A30** are the flood insurance rate zones used for the 1-percent-annual-chance floodplains that are determined for the FIS by detailed methods of analysis.

Zone AH is the flood insurance rate zone used for areas of 1-percent-annual-chance shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet.

AO zones are areas of sheet-flow shallow flooding where the potential runup is less than 3.0 feet above an overtopped barrier crest (ΔR<3.0 feet). The sheet flow in these areas will either flow into another flooding source (AE zone), result in ponding (AH zone), or deteriorate because of ground friction and energy losses and merge into the X zone.

Zones B and **X (shaded)** are areas of 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance (base flood) sheet flow flooding with average depths of less than 1 foot, areas of base flood stream flooding with a contributing drainage area of less than 1 square mile, or areas protected from the base flood by levees.

Zones C and **X (unshaded)** are flood insurance rate zones used for areas outside the 0.2-percent-annual-chance floodplain.

Zone D designations are used for areas where there are possible but undetermined flood hazards. Flood insurance is optional and available, and the flood insurance rates for properties in Zone D are commensurate with the uncertainty of the flood risk.

VE zones are coastal high hazard areas where wave action and/or high-velocity water can cause structural damage during the base flood.

Users should verify designations, policies, regulations, and restrictions before making project commitments.

0 0.5 1 2 3 Miles

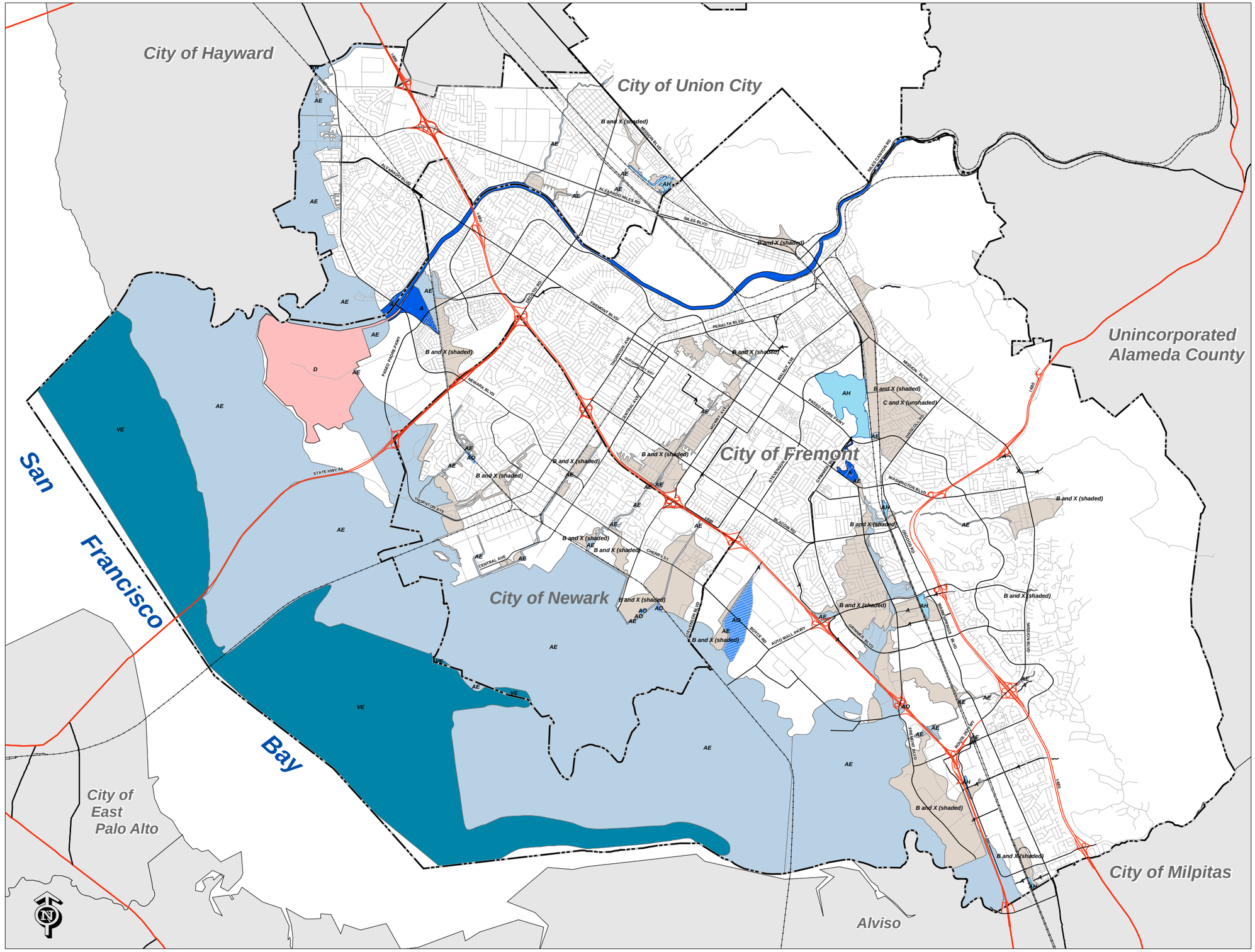

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FIGURE 6

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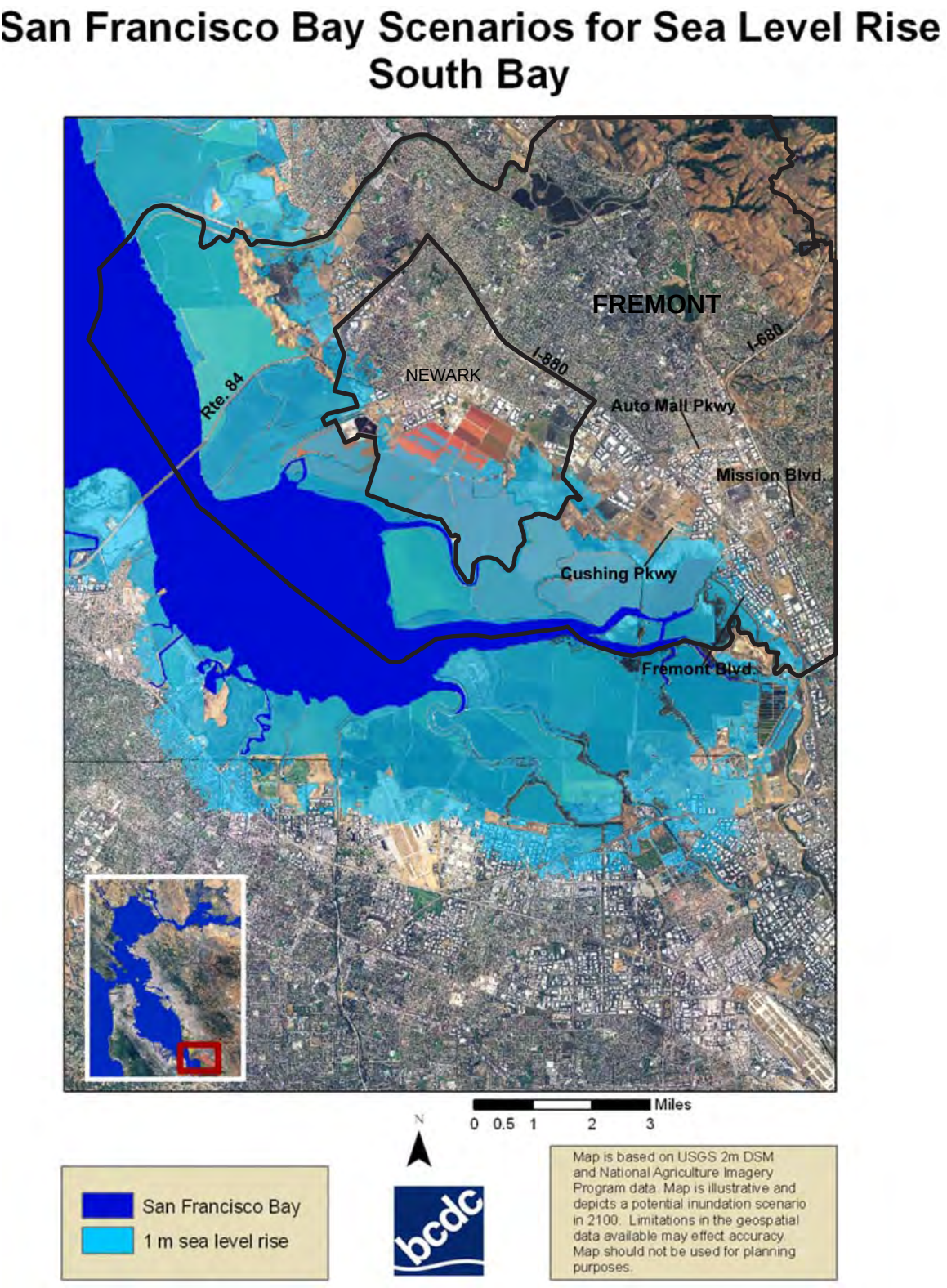
Figure 7



Source: http://www.bcdc.ca.gov/index.php?cat=56

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